

*EVALUATION OF A VOCAL MAND ASSESSMENT
AND VOCAL MAND TRAINING PROCEDURES*

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A common deficiency in the verbal repertoires of individuals with autism and related disorders is the absence of socially appropriate vocal mands. The vocal mand repertoires of these individuals may be lacking in several respects: (a) The individual might engage in no mands whatsoever, (b) the mand might be topographically dissimilar to an appropriate response, (c) the mand might be only partially topographically similar to an appropriate response, and (d) the mand might occur only after prompting. Depending on specific deficiencies in an individual's repertoire, different procedures for establishing appropriate mands may be needed. The purpose of Study 1 was to evaluate an assessment prior to teaching vocal mands for 3 individuals with developmental disabilities. The assessment showed that 1 individual displayed partial utterances of mands, 1 displayed vocal mands after mands had been reinforced, and 1 displayed vocal mands when prompted. Thus, in Study 2, a different teaching strategy was tested for each individual. Results showed that the assessment information could be linked directly to mand training for all 3 participants.

DESCRIPTORS: developmental disabilities, language, mands, response class

A mand is a verbal operant maintained by a characteristic reinforcer and is evoked by the establishing operation for that reinforcer (Skinner, 1957). An example might be the response "water please." This response is likely to be reinforced by someone providing water and is likely to occur following a period of time in which a person has not had something to drink. It is important to note that responses are classified as mands based on their controlling variables rather than on their topography. The vocalization "water please," the American Sign Language sign for water, or pointing to a glass of water might all be mands reinforced by access to water.

Preparation of this article was supported in part by Grant HD38698 from the National Institute of Child Health and Human Development. We thank Julia Fiebig and Alyson Hovenetz for their assistance throughout this study and Timothy Hackenberg, Brian Iwata, and Terry Scott for helpful recommendations on an earlier draft.

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Several studies have demonstrated the establishment of vocal manding (Drasgow, Halle, & Ostrosky, 1998; Simic & Bucher, 1980; Williams, Donley, & Keller, 2000; Yamamoto & Mochizuki, 1988). Manding was established in each of these studies; however, methods for the selection of the specific mand training protocol for individual participants were not described. Thus, it is not clear whether participants were selected on the basis of being responsive to a particular type of training or whether such training works for anyone with verbal deficits. In a number of studies, mand training has been implemented as treatment for problem behavior and has been referred to as functional communication training (FCT). Like studies on vocal mand establishment, many of the studies on FCT do not explicitly report how mand training procedures are selected or conducted (e.g., Carr & Durand, 1985; Hanley, Iwata, & Thompson, 2001; Kahng, Hendrickson, & Vu, 2000; Richman, Wacker, & Winborn, 2001; Winborn, Wacker, Richman, Asmus, & Geier, 2002; Tarbox,

Wallace, & Williams, 2003). Thus, it is not clear how the experimenters selected teaching strategies for the individual participants. Although vocal manding was established in these studies, no in-depth details were given concerning the specific procedures and length of mand training. Their procedures may have been more efficient, more replicable, or both, with an assessment prior to treatment indicating necessary components of procedures for mand training.

An important consideration when teaching verbal behavior is the range of audiences that will respond to the verbal response. Instead of establishing an idiosyncratic response that will be reinforced only in select circumstances (e.g., a particular vocalization understood only by a child's parents) one might choose to teach a response that is likely to be reinforced in the larger verbal community. Vocal mands with commonly recognizable topographies should then be preferred over sign language or communication cards in that they are more likely to be reinforced outside the training environment. However, vocal mands may be far more difficult to teach.

Parents or caregivers who refer a child for mand ("communication") training often report that the child does not ask for items he or she apparently wants. This complaint could actually mean several things. First, it is possible that the items to be requested are simply not reinforcers. If so, deprivation would not evoke the response, and the item or event presented as a consequence for the response would not reinforce behavior. Second, although the requested item may function as a reinforcer, it is possible that no mand for that item or event has been shaped or otherwise established. Third, the topography of the mand may be such that it is reinforced only in limited settings; this would occur if a child's mand were an unusual response that only the parent understood. Fourth, it is possible that a mand has

not contacted sufficient reinforcement, and, as a result, occurs rarely. Fifth, specific events, such as the presence of certain people, prompts, or situations, may acquire stimulus control over responding. An example of this might be when a child asks for things only when verbally prompted.

Each of these different manding deficits presumably would require a different teaching strategy, and a single treatment applied to all would either fail or include a number of unnecessary components. For example, shaping would not assist in generating mands if the response was under stimulus control exerted by prompts. Conversely, simply reinforcing a specific vocal topography may be ineffective in establishing it as a mand if the response form had never been previously shaped. Thus, efficient and effective mand training procedures may vary idiosyncratically among individuals.

The purpose of the present studies was to evaluate an assessment method for vocal mand deficits (Study 1), which was then used as the basis for implementing specific intervention strategies (Study 2). The vocal mand assessment was designed to be one possible component of an integrated group of assessment procedures, including clinical interviews, preference assessments, and functional analyses of problem behavior, to determine the variables that might compete with the establishment of vocal mands. The assessment was intended to be the first step in establishing vocal manding for individuals who do not, or do not often, emit vocal mands. The purpose of the vocal mand assessment was to select among common procedures used in the production of vocal mands: prompting, prompt fading, reinforcement, and shaping. This sort of analysis might be more efficient because it identifies the specific interventions that may be helpful (or irrelevant) in producing a desired outcome.

STUDY 1: VOCAL MAND ASSESSMENT

We evaluated an assessment method for identifying deficits in vocal manding. The procedures were designed to identify the conditions under which vocal mands did or did not occur.

METHOD

Participants and Setting

Participants were 3 individuals who had been referred by parents and caregivers because of deficiencies in their vocal verbal repertoires. We informed school administrators about the purpose of the study and selected the first 3 individuals referred. Will was 6 years old and had been diagnosed with autism. Although he was able to follow simple directions, his verbal repertoire was limited to gestures, and he engaged in no vocal communication. He was reported to have a short attention span and to have trouble staying in his seat during task situations. Mike was 14 years old and had been diagnosed with moderate mental retardation. Mike was able to follow simple directions but reportedly emitted no vocal verbal behavior. Nick was 18 years old and had been diagnosed with mild mental retardation. Nick followed fairly complex directions but was reported to engage in vocal verbal behavior under limited circumstances.

Sessions were conducted 3 to 5 days per week. One to three sessions were conducted per day, and each session was 10 min in duration. Will's sessions were conducted in a room in his home away from ongoing activity; Mike's and Nick's sessions were conducted in a relatively empty room at their school.

Selection of Stimuli

Tangible and edible stimuli used as reinforcers throughout both studies were identified in free-operant preference assessments

(Roane, Vollmer, Ringdahl, & Marcus, 1998). Each preference assessment was 5 min in duration and included an array of five to seven stimuli. All stimuli were placed equidistant from the participant, and data were collected on the duration of contact with each item. Tangible items and edible items were included in separate assessments for Will. The top one or two items were used as reinforcers in the vocal mand assessment and training procedures. Will's preferred edible items were chips and cookies; his preferred nonedible items were a radio and videos. Mike's most preferred item was a radio, which was used as a reinforcer throughout the investigation. Nick's preferred items were a radio and Play Doh®.

Procedure

One of the investigators met with the parents of each participant to identify topographies of vocalizations to be targeted as mands. The topographies chosen as mands for each reinforcer were selected based on the results of the preference assessment, ease of pronunciation, and the likelihood that the verbal community at large would reinforce the response. The reinforcer used in Will's assessment was access to chips, and the targeted mand was the word "chip." The reinforcer used in Mike's assessment was access to a radio, and the mand was the word "tunes." Access to a radio was used as Nick's reinforcer in the assessment, and the mand was the word "radio."

Each vocalization assessment session consisted of 10 trials, each 1 min in duration. A nonspecific prompt was delivered (e.g., "if you want this, ask me for it") 10 s after the onset of the trial. A prompt including a model of the complete targeted utterance (e.g., "if you want this, say 'chip'") was delivered 20 s into the trial. The participant was prompted to say just the first phoneme of the targeted response (e.g., "if you want this, say 'ch'") 30 s after the initiation of the

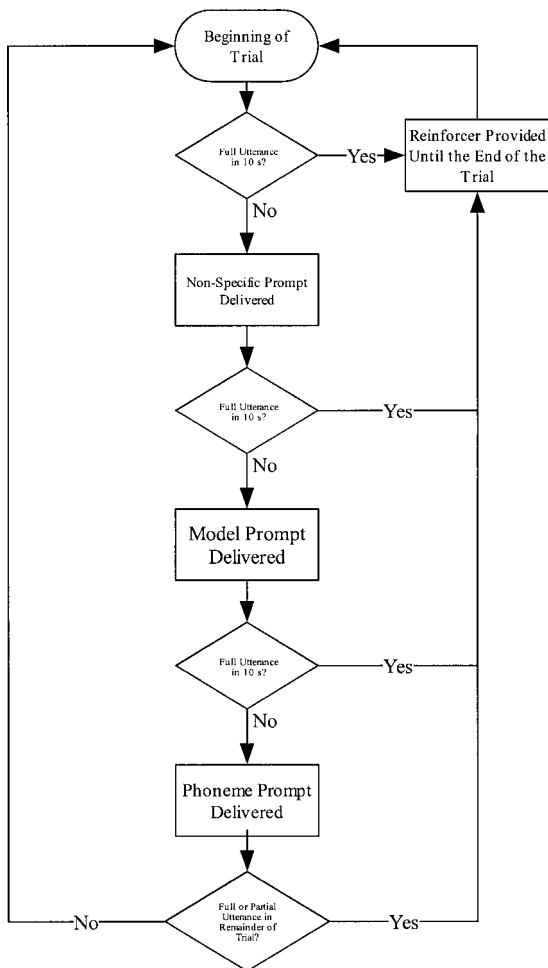


Figure 1. Flow chart depicting the order of events during each 60-s trial of the vocal mand assessment.

trial. Figure 1 shows the order of events for each trial.

If at any time the participant said the entire targeted word, the reinforcer was delivered for the remainder of the trial and all further prompts were eliminated. If the participant uttered the modeled phoneme within 10 s of the phoneme prompt, access to the reinforcer was allowed for the remainder of the trial. Thus, if the participant said the full utterance at Second 5 of the trial, he would be allowed access to the available reinforcer for the remaining 55 s of the trial and no prompts would be delivered. If the participant said the full utterance at Second

25, he would gain 35 s of access to the reinforcer and the phoneme prompt would not be delivered. If the participant said the modeled phoneme (or the whole word) at Second 35 (5 s after the phoneme prompt), he would receive 25 s of access to the reinforcer.

The prompt sequence and reinforcement contingencies were arranged to maximize the likelihood of the participant responding at, or close to, the terminal goal of unprompted full utterances. The 10-s pause between the beginning of a trial and the occurrence of the first prompt was designed to allow unprompted responding. The nonspecific prompt was delivered first to determine if the targeted response would occur in the absence of a model. The model prompt was delivered before a phoneme prompt to increase the likelihood of observing a full utterance rather than a partial utterance. The phoneme prompt was delivered 30 s into the trial, and partial utterances were reinforced only following this prompt, whereas full utterances were reinforced at any time after the initiation of the trial. The purpose of delivering the model prompt was to determine whether the target response would occur as imitation. If responding occurred and was maintained consistently following the model prompt, prompting and reinforcement would be indicated as an effective procedure for production of vocal mands. The purpose of including phoneme prompts was to determine whether imitation of an approximation to the targeted response would occur with prompting and reinforcement; if so, shaping would be indicated. The shorter delay to reinforcement and relatively longer duration of obtained reinforcement for full utterances were arranged to enhance the likelihood of observing a full utterance. The prompt sequence and reinforcement contingencies were designed to determine the necessity of more intensive interventions for the production of a targeted topography of

unprompted manding (e.g., more extensive reinforcement, shaping, prompt fading, or some combination).

Response Definitions, Recording, and Reliability

Observers used either laptop computers or a printed data sheet to record vocalizations. Full utterances were scored for the words “chip,” “tunes,” and “radio” for Will, Mike, and Nick, respectively. The emission of any portion of the full utterance was scored as a partial utterance for all participants (e.g., “ch” for Will). Observers also scored the therapist’s delivery of prompts and reinforcers. Observers scored each of the three prompts separately (nonspecific prompt, model prompt, and phoneme prompt).

A reliability observer simultaneously and independently collected data during 36.4% or more of the sessions for each participant (range, 36.4% to 55.6%). Agreement was calculated by dividing each session into 10-s intervals, dividing the smaller number of recorded events by the larger across observers, averaging these scores across the session, and converting them to a percentage. Overall agreement scores for all participants on all measures (participant vocalizations, therapist prompt delivery, and therapist reinforcement delivery) in assessment and treatment averaged 92.5% (range, 85% to 100%).

RESULTS AND DISCUSSION

Figure 2 shows the results of the vocal mand assessment for all participants. In the top panel, the proportion of trials in which Will said a partial utterance of “chip” is plotted across sessions. A partial utterance was emitted at various levels of prompting during the first six sessions. Partial utterances decreased in Session 7 and did not occur at all in Sessions 8 through 11.

The second panel depicts the proportion of trials in which Will produced the full ut-

terance of “chip.” The full utterance was observed in only one of the first five sessions (Session 3), twice following model prompts, and once following the nonspecific prompt. Thereafter, full utterances increased under varied prompting conditions. Most important, the full utterance in the absence of prompting increased across sessions and occurred during all trials of the last two sessions. These results suggest that Will’s exposure to the prompts and reinforcement contingencies of the assessment was sufficient to produce the terminal mand topography independent of prompting. These results also suggest that vocal mand training for Will should consist of exposure to reinforcement for initially prompted vocal mands. The effects of this treatment were evaluated in Study 2.

The third panel of Figure 2 shows results of the vocalization assessment for Mike. Only partial utterances are depicted because full utterances were never observed. Partial utterances were observed only after phoneme prompts. Because Mike never emitted the targeted topography but did emit an approximation, these results suggest that shaping would be necessary to produce the full utterance (unlike Will, for whom the full utterance emerged over the course of the assessment), and the effects of shaping were evaluated in Study 2.

The fourth panel of Figure 2 displays the results from the vocalization assessment for Nick. Nick reliably said the full word “radio” during the assessment, so data on partial utterances are not presented. Nick never said “radio” in the absence of a prompt but was likely to say it following the nonspecific prompt. These results indicate that Nick could emit the targeted mand but did so only after prompting. A logically related treatment in this case was prompt fading, which was evaluated in Study 2.

The assessment results for each participant suggested a different procedure for pro-

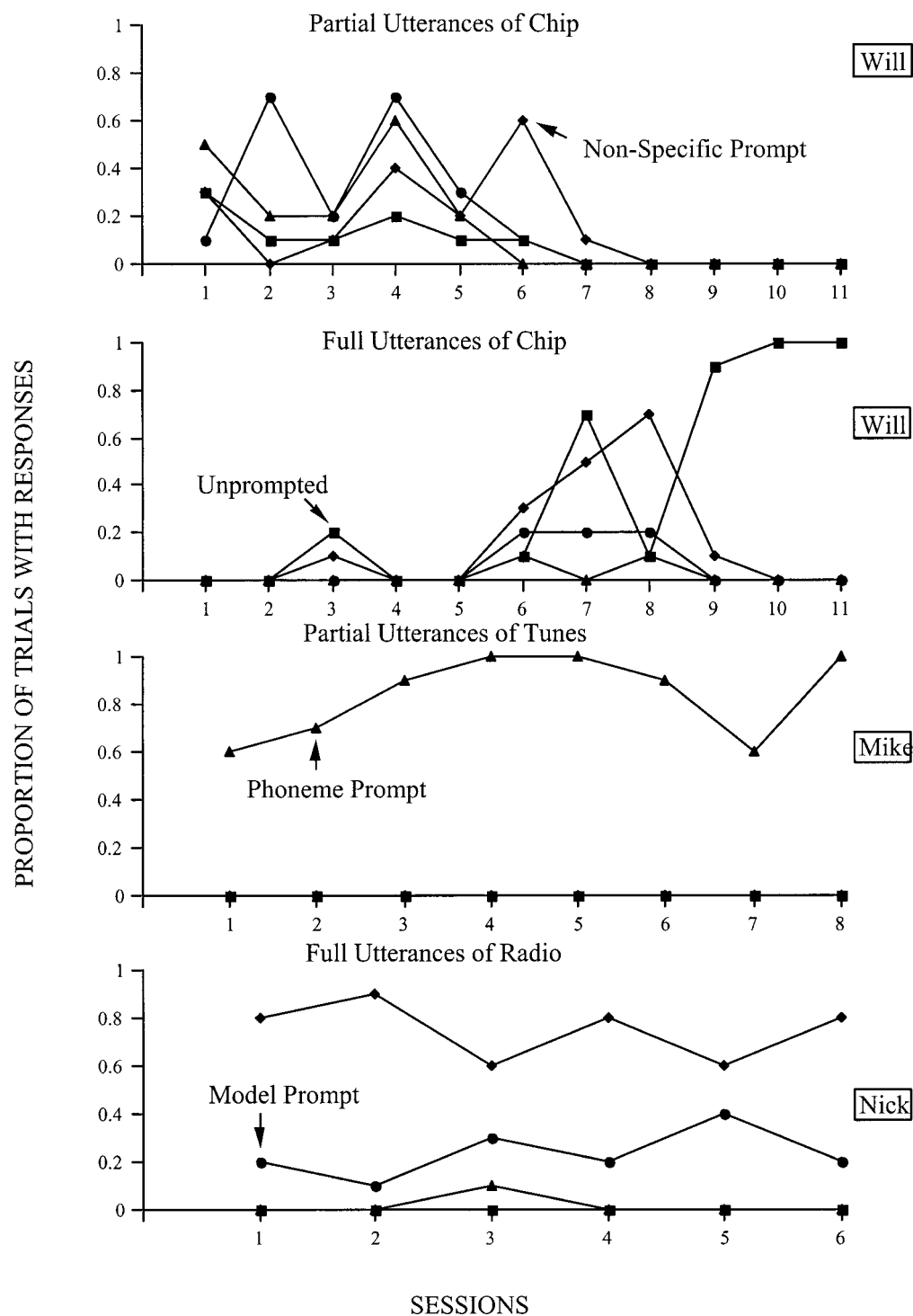


Figure 2. Proportion of trials in which partial and full utterances of a targeted mand were observed for Will, partial utterances were observed for Mike, and full utterances were observed for Nick.

ducing vocal mands. Will's targeted mand emerged in the absence of prompting over the course of the assessment as the mand contacted reinforcement. Mike emitted no full utterances, and his partial utterances were observed only following a phoneme prompt, indicating that shaping might be necessary to produce the targeted topography. Nick emitted the full target response, but only after prompting. Hence, a prompt-fading procedure was indicated.

STUDY 2: TREATMENT

WILL: PROMPTING AND REINFORCEMENT

In Study 1, Will's targeted mand emerged and began to occur independent of prompting during the course of the initial assessment. Thus, the assessment suggested that prompting and reinforcement would be an appropriate teaching strategy. However, to test the predictive utility of the assessment, these effects would need to be replicated using an appropriate experimental design. In treatment, prompting and reinforcement were implemented to produce two new mand topographies.

Method

Will's targeted mands were the words "music" and "video." Access to a radio or a videotaped movie was used as the reinforcer. During baseline, no prompts or reinforcers were delivered, but the items were in Will's view. During treatment, the prompting and reinforcement procedures were identical to those in Study 1. A multiple baseline across behavior design was used to demonstrate experimental control.

Results and Discussion

Figure 3 shows the proportion of trials in which Will said "music" (top panel) and "video" (bottom panel) across sessions. Will never said either word in baseline. When the prompting and reinforcement procedures

were implemented for the mand "music," the word was emitted for the first time. There was an upward trend in unprompted responding until around Session 40, after which the proportion of trials that "music" was emitted without a prompt varied from .3 to 1.0. Prompted responses were maintained throughout the phase at varying levels. When the prompting and reinforcement procedures were implemented for "video," the word was observed for the first time. Unprompted utterances of "video" were then observed at varying levels, although an upward trend was observed beginning on Session 7. The proportion of trials with unprompted manding was .6 or greater for eight of the final nine sessions. Prompted responses were also maintained throughout the phase but decreased as unprompted responses increased.

These results provide a systematic replication of the findings from Study 1 for Will and a verification of the treatment derived directly from the assessment results. Exposure to the prompting and reinforcement contingencies of the assessment were sufficient to produce the mands "music" and "video," ultimately in the absence of prompting. It appears that prompting was necessary to evoke a change from zero responding to low levels of prompted responding. Then, the response contacted reinforcement and gradually began to occur independent of prompting.

MIKE: SHAPING AND STIMULUS FADING

Because Mike's assessment (Study 1) showed that he imitated a phoneme portion of a targeted mand but not the full topography, shaping was chosen as a treatment related to the assessment outcome. Also, because responding observed in the assessment occurred only after prompts, the treatment involved using prompts of successive approximations to the targeted mand. Thus,

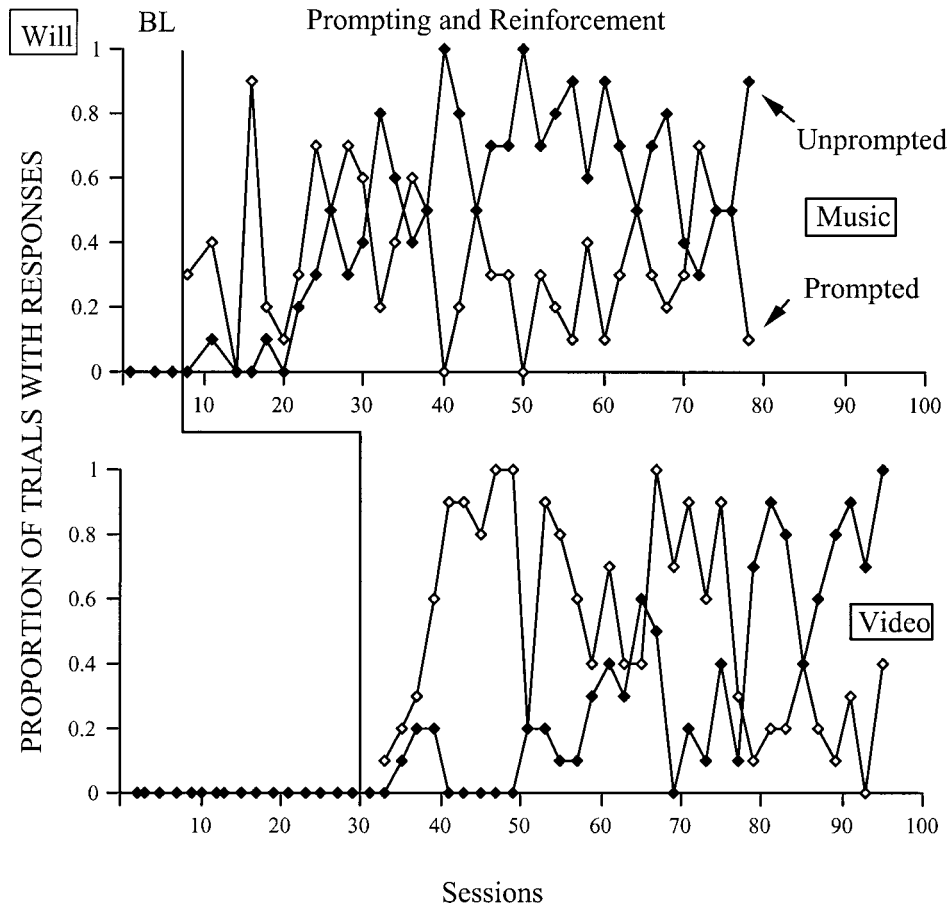


Figure 3. Proportion of trials with targeted vocalizations during baseline and treatment for Will.

the prompts were changed gradually to include more and more of the targeted mand.

Method

Mike's targeted mand and reinforcer were identical to those used in his assessment (i.e., the word "tunes" and access to a radio). Each session consisted of 10 trials. Each trial was 1 min in duration. In each phase, the prompts and the reinforcement contingency were changed. A variation of the changing-criterion design was used to demonstrate experimental control (Hartmann & Hall, 1976).

In Phase 1, a nonspecific prompt (e.g., "if you want this, ask me for it") was delivered 10 s into each trial. A full utterance that occurred at any time resulted in access to the

radio for the remainder of the trial; any other response produced no programmed consequence. In Phase 2, the nonspecific prompt was replaced with a prompt containing a model of the full utterance (e.g., "if you want this, say 'tunes'") 10 s into each trial.

In all subsequent phases, shaping and stimulus fading were implemented. A prompt containing a model of the complete terminal response was delivered 10 s into each trial. A second prompt, consisting of a part of the terminal response, was delivered 20 s into each trial. Across phases, this stimulus was faded to include successive approximations to the terminal mand. During all of the shaping and stimulus fading phases, full utterances of the terminal mand that oc-

curred at any time resulted in access to the radio for the remainder of the session (this never happened until the final phase). Imitation of the target prompt within 10 s also resulted in access to the radio for the remainder of the trial. Thus, as the target prompt successively approximated the terminal response topography across phases, so did the criterion for reinforcement. Once reinforcement was delivered in a given trial, any scheduled prompts that had not been delivered were omitted.

In Phase 3, the target prompt and criterion for reinforcement within 10 s following that prompt was a "t" sound (i.e., the target prompt was "If you want this, say 't,'" and the emission of a "t" sound within 10 s of that prompt resulted in reinforcement). In Phase 4, the target prompt and reinforcement criterion were faded to "tu." In Phase 5, they were changed back to "t," and in Phase 6 back to "tu." In Phase 7, the reinforcement criterion remained the production of "tu," but the target prompt was changed so that each sound in the prompt was emphasized with approximately a 0.5-s pause between them (i.e., first the "t," then a 0.5-s pause, then the "u"). In Phase 8, the target prompt and reinforcement criterion were faded to "tune," and the second prompt was again delivered such that each component sound was emphasized. The full utterance of "tunes" was the target prompt and reinforcement criterion in Phase 9, and each component sound was emphasized in the target prompt. Although some prompts were presented with brief pauses between components, only utterances emitted smoothly, with no pauses between component sounds, were scored as correct responses.

Results and Discussion

Figure 4 shows the results of the shaping and stimulus fading procedure for Mike. Each panel shows the proportion of trials in which a particular approximation to "tunes"

occurred. Each approximation was scored separately, such that if "tunes" was observed, it was scored only as an occurrence of "tunes" and not also "tune," "tu," and "t."

In the first phase, with only the nonspecific prompt, only the "t" sound was observed, and it only occurred in one trial in the first session. In Phase 2, when the model prompt was delivered, no approximations of "tunes" were observed. In Phase 3, when "t" was prompted and reinforced, occurrence of "t" ranged from .6 to 1.0 (proportion of trials). "Tu" was emitted once in the first session of Phase 3. In Phase 4, when the target prompt changed to "tu" and the response criterion for reinforcement changed to "tu," a decreasing trend was observed in "t," and the proportion of trials that "tu" was observed was .4 in the second session and 0 in all other sessions. Phase 5 was a replication of Phase 3 and resulted in an increase in "t" and no occurrences of closer approximations. In Phase 6, which was a replication of Phase 4, "t" decreased initially, but there was an upward trend across the phase. The proportion of trials in which "tu" was observed was .1 in the second session and 0 in all other sessions. In Phase 7, when the "tu" prompt was changed such that each sound was emphasized and the criterion response for reinforcement remained at "tu," the proportion of trials containing "tu" increased and ranged from .1 to .9 (see second panel of Figure 4). No closer approximations were observed. In Phase 8, in which the target prompt was "tune" with each component sound emphasized and the reinforcement criterion was changed to "tune," the proportion of trials with "t" varied from 0 to .7. The proportion of trials with "tu" dropped initially, but increased in Session 72 and ranged from 0 to 1.0 for the remainder of the phase. The proportion of trials with "tune" increased from 0 in all previous phases to a range of .2 to 1.0. In Phase 9, with only the full utterance being reinforced and

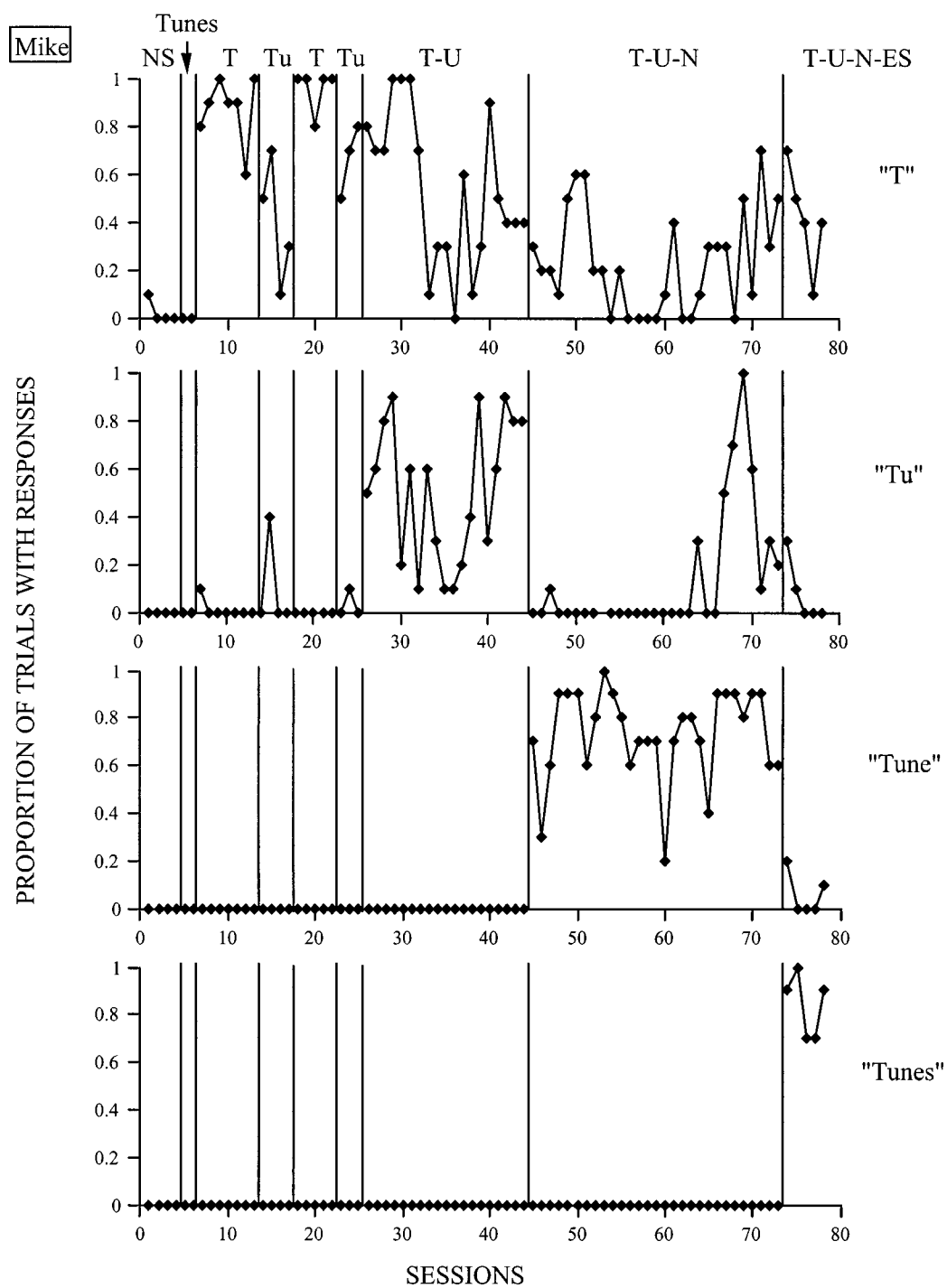


Figure 4. Proportion of trials with targeted vocalizations across shaping phases for Mike.

the second prompt being “tunes” with each sound emphasized, downward trends were observed in the proportion of trials that “t,” “tu,” and “tune” occurred. The proportion of trials with the response “tunes” increased from 0 in all previous phases and was maintained within a range of .7 to 1.0.

These data indicate that shaping and stimulus fading were effective in producing a novel topography of mand for Mike. New topographies did not emerge until the second prompt and reinforcement contingencies were changed to successive approximations to the terminal response topography. A limitation of the analysis for Mike was that prompts were never eliminated from the teaching sessions.

NICK: PROMPT FADING

Nick’s assessment of vocal manding (Study 1) showed that he frequently uttered the word “radio,” but only following prompts. Because the targeted topography was already in Nick’s repertoire, shaping was not necessary. However, because the response was prompt dependent, a prompt-fading procedure was implemented to weaken the control exerted by prompts.

Method

Nick’s assessment (Study 1) was used as the first six sessions of baseline, with one additional session conducted under conditions identical to those during the assessment. In the prompt-fading phases, the procedure was identical to the assessment except that only one prompt was delivered per trial. That prompt occurred 10 s after the beginning of each trial and was omitted if a full utterance occurred before the prompt was scheduled to be delivered. The prompts in the assessment always began with “Nick, if you want this say,” the prompt in the first fading phase was “Nick,” and the prompt in the second fading phase was “Ni.” A full utterance that occurred at any time resulted in

access to the reinforcer for the remainder of the trial. Two mands were targeted for Nick—“radio,” which was reinforced by access to a radio, and “Play Doh,” which was reinforced by access to Play Doh®.

Results and Discussion

Figure 5 shows the results for Nick. In baseline, “radio” occurred primarily following the nonspecific prompt, and was second most likely following the model prompt. There was only one occurrence after a phoneme prompt, and “radio” never occurred in the absence of a prompt (recall that Nick had 10 s to respond before a prompt was delivered). In the second phase, in which only the prompt “Nick” was delivered, the proportion of trials with prompted responses was between .9 and 1.0 and the proportion of trials with unprompted responding was 0. In Phase 3, when the prompt was faded to “Ni,” the proportion of trials with prompted responding decreased and was at 0 for the final three sessions. The proportion of trials with unprompted responding (those that occurred in the 10-s interval between trial onset and the first prompt) increased from .2 during the first two sessions to 1.0 in the final three sessions. Baseline procedures remained in effect for “Play Doh” across all sessions. The proportion of trials with responding following the nonspecific prompt decreased to 0 for the last three sessions. The proportion of responses following the model decreased to 0 for the final five sessions. Only unprompted responding occurred during the final three sessions. The increase in unprompted responding is problematic because experimental control of the increase in unprompted responding shown in Panel 1 following prompt fading was not demonstrated (the original plan was to conduct a multiple baseline across mand topographies). This can be attributed to either generalization from the treatment condition or the effects of unknown extraneous variables.

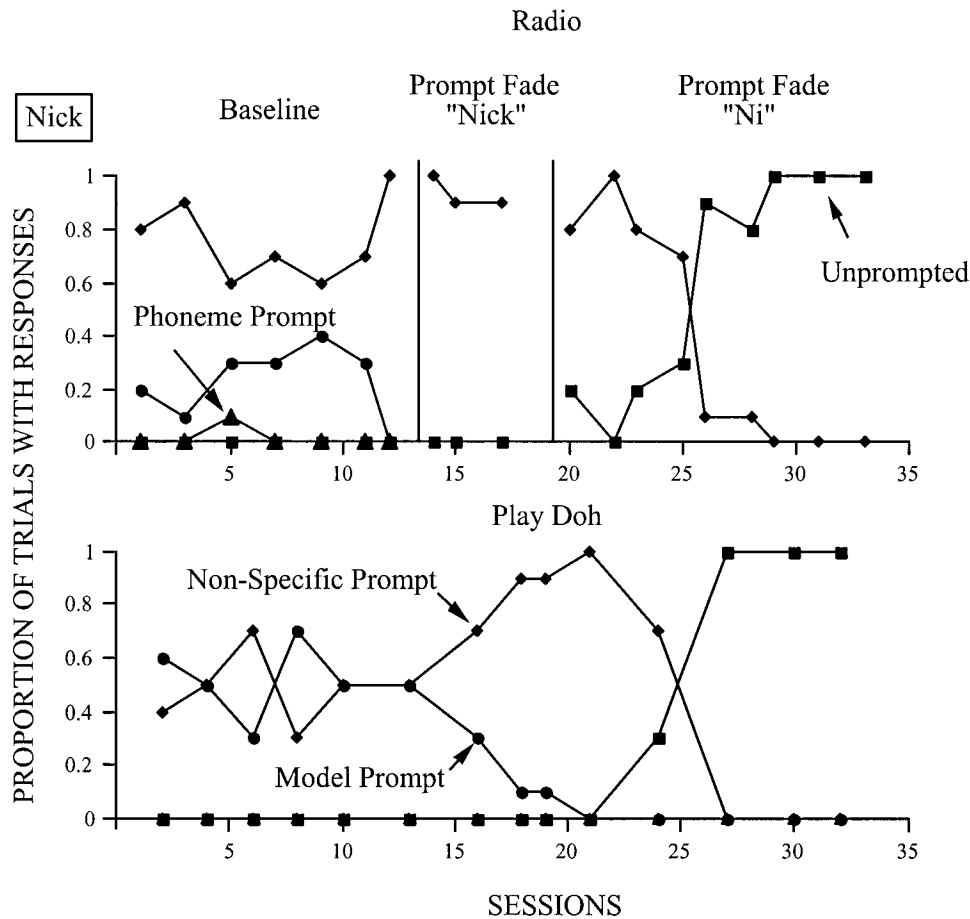


Figure 5. Proportion of trials with targeted vocalizations at various prompt levels during baseline and fading conditions for Nick.

GENERAL DISCUSSION

The present studies evaluated the utility of a pretreatment assessment of an individual's vocal manding repertoire. The critical test of such an assessment is the degree to which it differentially indicates an effective teaching strategy. The desired outcome of mand training is a response topography that is likely to be reinforced by a broad verbal community and that is under the control of the establishing operation for a particular reinforcer and not under the discriminative control of some limited set of stimuli. The assessment conducted in Study 1 was designed to identify the closest approximation

to a targeted topography in an individual's repertoire and conditions under which that response is likely.

In Study 1, the vocalization assessment produced different outcomes for each participant. Will's unprompted mands emerged over the course of the assessment, and exposure to prompts and reinforcement (Study 2) was sufficient to produce two novel mands. Mike's closest approximation to the targeted mand in the assessment (Study 1) was imitation of the phoneme prompt. A procedure using modeling, shaping, and stimulus fading was successful in producing a new vocal mand. Nick's assessment (Study

1) showed that his target vocal mand occurred only following prompting. A prompt-fading procedure was implemented to engender responding in the absence of prompts. Prompt-independent mands emerged following prompt fading for one response and also for the response still in baseline at approximately the same time.

Will's assessment and treatment results demonstrate the effects of prompting and reinforcement. The arrangement of prompts within each trial and the reinforcement contingencies were designed to favor the occurrence of the full topography of a target response independent of prompting. A full utterance that occurred at any time resulted in immediate access to reinforcement for the duration of the trial. The first prompt was not delivered until 10 s into the trial, so an unprompted response resulted in quicker access to the reinforcer and a longer reinforcement interval. Partial utterances were reinforced only after the phoneme prompt, which occurred at Second 30 of each trial. Thus, although the occurrence of the complete topography of the target response might be reinforced immediately and result in close to 60 s of reinforcement, partial utterances were on extinction for the first 30 s of the trial and could at most result in 30 s of reinforcement. Will's responding, as demonstrated in Figure 2, initially occurred under the control of prompting, but only two exposures to reinforced responding prior to the first prompt resulted in a shift in the distribution of responding within trials such that the proportion of trials with responses before the first prompt in the final three sessions were .9, 1.0, and 1.0. These data replicate previous research demonstrating the effects of reinforcement contingencies that favor unprompted over prompted responding (e.g., Touchette & Howard, 1984). Touchette and Howard showed prompt delay to be effective in transferring stimulus

control even when schedules of reinforcement favored prompted responding.

An advantage of the assessment method used in Study 1 is the ease of its implementation. Three prompts were delivered (at 10, 20, and 30 s into the session) and, if a targeted response occurred, reinforcement was delivered for the remainder of the trial. The assessment can be fairly short. In the current investigation the assessments lasted for 6 to 11 sessions. The only materials necessary are a data sheet, a watch, and a reinforcer.

A limitation is the intensive nature of the intervention in some cases, such as with Mike. An inordinate amount of time was spent teaching one mand. From a clinical standpoint, some other communication mode would be preferable. In fact, we taught Mike an extensive mand repertoire using picture cards outside the context of this study. Nonetheless, from a standpoint of research, it was necessary to demonstrate that a shaping procedure was useful, given the assessment results. It could be that such information would ordinarily be used to select a more readily acquired mand topography (like pointing to picture cards). However, it may also be the case that teaching new vocal mands gets progressively easier. That question could be addressed in future research.

A consistent finding across participants was anecdotal report of dramatic increases in speaking outside therapy sessions. The present studies are limited in that no data were systematically collected on generalization of observed increases in speaking. Will and Mike had no vocal verbal repertoire prior to their participation in these studies. Following our work with these participants, both were observed to engage in numerous episodes of vocal verbal behavior, including responses taught as part of their participation in the present studies and novel topographies. After Will's participation in these studies, his parents taught him to say "mom" and "dad" as mands for attention using pro-

cedures similar to those in Study 2. Nick had a significant vocal verbal repertoire prior to his participation, but he only infrequently engaged in unprompted vocal verbal responding. Following his participation, he was observed to engage in frequent unprompted vocal verbal behavior. The concept of the behavioral cusp (Bosch & Fuqua, 2001; Rosales-Ruiz & Baer, 1997) might be useful in accounting for this language explosion following acquisition and reinforcement of vocal verbal responding. A behavioral cusp is, essentially, a behavior change that brings the organism into contact with contingencies of reinforcement not previously encountered. As might have been the case for participants in these studies, the emission of vocal verbal behavior produced access to a number of previously unavailable reinforcers.

A potential limitation of the present studies is the absence of a comparison between treatments that were and were not suggested by the assessment. An argument could be made that treatments other than those linked to the assessment might have been as successful as those suggested by the assessment. True, any number of treatments may have been as effective, but they may also have included unnecessary components, making them less efficient. The assessment added to the efficiency of procedures designed to establish vocal manding through ruling out unnecessary components (e.g., shaping was not necessary for Nick, and no procedures beyond the assessment itself were necessary for Will). By ruling out unnecessary components of treatment, the utility of the vocal mand assessment was demonstrated in the absence of direct comparison to alternative treatments. The argument might be made that the time involved in conducting the assessment offsets any time saved by avoiding implementing unnecessary treatment components, but the brevity of the assessment (6 to 11 10-min sessions) argues

against this supposition. The identification of effective treatment components through the assessment may further add to the efficiency of mand training procedures. For example, Mike's assessment showed that he would imitate a phoneme component of the target response, but not the entire response. A treatment involving prompting the full utterance alone would have likely failed and a new treatment would have had to be developed.

Further research is needed on the utility of pretreatment functional analyses of responses targeted for acquisition. These sorts of analyses are likely to be useful when a number of factors may account for the absence of a target response. If a child is not completing homework assignments, for example, it is possible that the required responses are not in the child's repertoire, that the consequence for homework completion is not a reinforcer, or that homework completion is under the control of having another person present providing assistance. Completing homework is also an example of a complex response or series of responses. It might be that some component response is lacking (e.g., the child might not be able to read or write). In these cases, systematic pretreatment analyses might prove to be useful in identifying effective and efficient treatments.

This study extended previous research on assessment-based instruction in which researchers have conducted assessments of participants' relevant repertoires prior to the initiation of a treatment designed to promote acquisition of, or improvement in, certain skills (Daly, Martens, Dool, & Hintze, 1998; Daly, Martens, Hamler, Dool, & Eckert, 1999; McComas *et al.*, 1996). In short, pretreatment behavioral assessments seem appropriate for a wide range of skill-acquisition targets. In this series of studies, we chose to evaluate vocal mands to illustrate

the logic of linking behavioral assessment to the teaching strategy.

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Received December 3, 2002
 Final acceptance February 17, 2004
 Action Editor, Dorothea Lerman

STUDY QUESTIONS

1. What are the characteristics of a mand?
2. Describe the prompt sequence and the reinforcement contingencies used during the vocal mand assessment.
3. Summarize the results of the vocal mand assessment and describe how they served as the basis for the treatments implemented in Study 2.

4. The authors concluded that prompting was initially necessary to evoke Will's mands. What type of experimental manipulation would have provided further support for this conclusion?
5. How did the authors explain the emergence of Will's unprompted manding in the absence of prompt fading?
6. What conclusions did the authors reach about Mike's suitability for vocal mand training?
7. What feature of Nick's results places limitations on the degree to which one can say that prompt fading increased vocal utterances?
8. As suggested by the authors, what additional data would have assisted in confirming or disconfirming the conclusion that treatment for vocal manding based on direct assessment leads to the most effective treatment?

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